

BRIDGES AND BRIDGE BUILDING

BY FREDERIC J. HASKIN

The collapse of the great steel bridge over the Lawrence a few weeks ago called the wisest engineers and turned more conservative element of Americans into doubting Thomases when anyone dared to suggest that steel could stand its own weight. It was pointed out that the fact that it was annually a failure of thirty bridges, great and small, in this country in proof of the fact that bridge building has not yet reached the stage of an exact science. They overlooked the thousands of successful structures that lie in the footsteps of the modern engineer knitting the wide banks of rivers with each other, and giving railways eliminate space. Where there were once barriers, modern industry has removed all such limitations and in that progressive era of ours when Old World ingenuity and capital have bridged the English channel with twenty miles of steel and put an end to the mad dream and great life, the kingship of steel and the rights of his grand viziers, the engineers, will be recognized without hesitation.

In the Old World bridges follow the line of highways. In the United States they anticipate highways because the railways are more often the main arteries. The Indians used no bridges, but a chance fallen log, usually prearranged to ford a stream at its mouth, there the silt had made the current shallow. Pioneers made temporary affairs, and the first permanent one. Cast iron bridges came into use when railways became sure things. Italian engineers had thought of iron as a bridge material as early as the sixteenth century, and England built one of iron in 1791. The first in America was at York, N. Y., in 1840, though Washington had correspondence on the subject as early as 1796. Now all America's bridges, placed end to end, would more than span the width of the continent.

Bessemer's experiments made steel cheaper than wrought iron, and a new dawn in bridge making. A distinctive type has arisen in which the architect will have to consult with the engineer before a perfect bit of art is attained. For while a stone bridge, with its usual complement of moss and vines, is always picturesque, and a wooden bridge gathers a gray hue from the weather, an iron or steel structure has to be kept aggressively new, a coat of paint to protect it from the ravages of wind and rain. A German architect claims that America has perfected beauty to utility in bridge building, but the most modern structures are disproving this. American bridge builders lead the world. When the great Gokteik viaduct over the Chungking river in Burma was projected, it was an American skill and American steel that perfected it, under the spur of English capital.

The first use of steel in large arches in America was Capt. Eads' bridge over the Mississippi at St. Louis. The manufacturer of steel was not then nearly perfected as it is now, and the task was enormous. This was the first application of the pneumatic pro-

cess on a large scale, and it was here that physicians began making the first study of the effect of air pressure on the bodies of workmen in the caissons, marveling over the great pressure, which they found to be fifteen pounds to the square inch, and increasing with depth. Caissons had by this time superseded cofferdams in pier building, and marked many centuries change since Queen Semiramis had deflected the course of the Euphrates to build her bridge and raise Babylon to the grandeur of Nineveh. The St. Louis bridge was begun in 1867 and finished in seven years at a cost of \$10,000,000. Suspension bridges are very, very old. Ants and monkeys in living chains gave the idea to South American and African natives, who developed it in vines and boughs. Roebeling's famous bridge at Niagara was the first of the kind in this country. Then came one at Pittsburgh, and Cincinnati followed the world with one having a span of 1003 feet. Then Roebeling's Brooklyn bridge, "the eighth wonder of the world," it was called, marked the climax of suspension bridge work in the United States. It swung clear of the waterway by 135 feet, with the central span of 1595 feet, the largest in the world, though the projected North river bridge expects to have a span of nearly 3000 feet.

The new East river bridge of New York cost \$9,000,000. The cables of steel are of six times the strength usually required as one the size of a man's thumb will support a car containing 1500 men. The main cables are the size of a barrel, and cost \$1,395,000 each, thousands of fine wires being woven into cylinders, each of which can support 50,000 pounds. The foundations are laid 100 feet below water level, and the two-story platform, twice as wide as a city street, carries six trolley and elevated tracks, two wide carriage tracks, two bicycle paths, and two promenades.

In 1820 Ithiel Towne patented a wooden lattice bridge; in 1830 Long patented a truss bridge called for him, and in 1840 Howe an improved wood bridge for railways. When the Ohio was bridged in 1863 with a 320-foot iron span the beginning of long spans for railroads was marked. Since 1870 most railway bridges have reached a span of over 500 feet. The Conemaugh viaduct on the Pennsylvania road and the Carrollton viaduct on the Baltimore and Washington, famous in their day, are now surpassed by more wonderful structures. Improved facilities have made quick work possible. The single steel span was replaced not long ago on the Pennsylvania road over the Schuylkill, at Philadelphia, in fifteen minutes, there being not a second's delay in trains. Buche replaced the cables on Niagara bridge and put in steel towers, instead of masonry, without interrupting the traffic.

The first metallic cantilever in the world is said to have been built by C. Shaler Smith over the Kentucky in 1877, though this is disputed by Poland, who claims to have had one over the Vistula at Posen before this. The longest single steel cantilever span in the

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United States is over the Mississippi at Memphis. The builder of the great Niagara bridge gave to the world the greatest steel arch it has ever known, a clear span of 840 feet, 200 feet above the pool. The cantilever idea is very old, and has been developed in a crude fashion for centuries ever since Japan built the Shogun bridge at Nikko before the sixth century.

Distance, height and depth seem to have no terrors for American bridge builders, and they are said to have overcome more natural difficulties than the engineers of any other nation. The Southern Pacific crosses the Pecos in southern Texas on a bridge 320 feet above the river, on a trestle work 2180 feet long. It was built by sixty-seven men in eighty-seven days, and is one of the four highest in the world. The Gokteik viaduct in Burma is 800 feet high, one in Germany is 341 feet, and the third, in Bolivia, is 326 feet high. Long China had a bridge that sprang from one mountain crest to another, a distance of 750 feet, and was 600 feet above the gorge.

Pontoon bridges have not improved since the day Alexander crossed the Ganges by their aid. Soldiers beat know their value, and since the days of Cortez in Mexico each war-swept section has seen its streams bridged in this fashion. The only floating bridge in the world that is not built on boats is believed to be in Lynn, Massachusetts. It was built in 1802 when the pond it crossed was supposed to be bottomless. It was anchored to each shore and though heavy and water-logged, still remains as a historic relic, its original thickness of five and a half feet having been increased to seven feet by continual patching. The largest concrete bridge in the world is that over the Santa Ana on the San Pedro, Los Angeles and Salt Lake railroad, a few miles from Riverside, California. It was built in 1903 when steel was not immediately available, all shops being several months behind, and 200 men completed it in an incredibly short while at a cost of \$200,000.

The most valuable wooden bridge in the world is that built across Pine creek in Warren county, Indiana. It was built nearly a century ago entirely of black walnut, and is valued at \$15,000. Lumber dealers have made many offers for it, and bridge builders have offered to replace it with steel, but the county prefers to keep it. For many years the longest single stone arch in the world, since the destruction of the 250-foot arched bridge over the Adia in the fourteenth century, was that of Cabin John Bridge over the Potomac. This was built in 1879 by General Meigs and springs high across a ravine in an arch of 220 feet carrying the aqueduct for the city water supply. Switzerland is now offering a rival arch a few feet longer.

The most historic bridge in the United States was the famous Long Bridge across the Potomac at Washington, which was torn down last winter. It was an unsightly affair completed in 1835 and formally dedicated by President Jackson in 1836. Over this marched a million men to southern battlefields in the Civil war, to the longing eyes of Confederate generals turned more than once when plans were on foot to take Washington, and over it defeated armies came pell-mell after the battles of Bull Run and other Virginia encounters. The timbers are now being cut into walking sticks as souvenirs for Grand Army men. The astonishing fact about the Long Bridge, and a fact that makes it distinctive above all others in the world, is that the builders spent only one-third of the money on it that Congress appropriated for the purpose.

A great national bridge, that will stand as a monument to General Grant and be one of the most ornamental and artistic now in existence, is some day to be built across the Potomac at Washington. It will be a bascule bridge with a draw span of 160 feet, and spans on each side of 240 feet each. The plans were drawn by Captain Symons of the United States Army engineering corps, and Paul J. Pelz, architect of the Library of Congress. Another proposed memorial bridge is one that New York is considering to mark the confines of the island at Spuyten Duyvil creek and commemorate the landing of Hudson in 1609.

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NEW YORK, Oct. 21.—General Ballington Booth of the Volunteers of America today sent his father, General William Booth, the following telegram: "Learning of your presence and illness in Chicago, I desire, apart from all official differences, to express my deep sympathy."

Of the reported amalgamation of the Volunteers of America with the Salvation Army, General Ballington Booth said today: "The movements are distinct in government, principle, organization and policy. As such, amalgamation could not be taken into consideration for a moment."

DeWitt's Kidney and Bladder Pills relieve backache, weak kidneys, and inflammation of the bladder. Sold by Anstee-Brice Drug Co., 44 South Main.

S. D. Evans, Undertaker and Embalmer, has removed to new location, 18 South State.

ORACLE'S GOOD HUMOR; SHOWS VISITORS ABOUT

Salt Lake Is Now Enjoying Better Weather Than Other Cities.

The weather man was hospitable Monday and took his visitors all up onto the roof to show them the various machines used in the manufacture of the weather. The sunshine instruments were pouring out brightness by the wholesale, and the windmaker was whirling around at the rate of forty miles an hour, it looked to the casual observer, but the weather man said "No, its only four." They saw the snow machine also: it was as dry as a bone and needed oiling. The oracle has the thermometer in a small cup, where no one can see it, so that one has to take his word for the temperature. He screwed up the barometer to a good high pressure and said, "It's going to be fair tomorrow." The rain machine was not working, so there won't be any doubt about it. The sun will shine today and the temperature will be good and comfortable.

It was pleasant all over the country Monday; in fact, the weather map looks just the same as it has for the past few days. Another area of high pressure has developed over the eastern Great Lakes district in place of the one that left for Europe Saturday. A slight area of unsettled conditions has prevailed over southern California for several days, but it will do no harm, the weather man says. A comparison of temperatures with other parts of the country for several days, however, shows that Omaha and Denver both suffered with cold last night, with 38 degrees each. There was nothing reassuring during the day either, for the former recorded only 56, with Denver at 66. Salt Lake, on the contrary, went no lower than 48 degrees and kept well within the comfortable limit for a maximum. The temperatures all up and down the Pacific coast were moderate Monday, but a cold wave struck many of the cities of the East, and records of 39, 32 and, in one case, 22 degrees came in from various places.

The following is the official report of the local office of the weather bureau for the twenty-four hours ending at 6 p. m. Monday: Maximum temperature, 70 degrees; minimum temperature, 48 degrees; mean temperature, 59 degrees, which is 9 degrees above normal.

Accumulated excess of precipitation since the first of the month, 82 degrees. Accumulated deficiency of precipitation since January 1, 3.25 inches. Local forecast for Salt Lake City and vicinity, Fair Tuesday.

Utah and west Wyoming: Fair Tuesday. Weather Conditions. The barometric conditions have changed but little since last report. High pressure existing over the most of the country, causing fair weather, with moderate temperature, in nearly all districts. The center of the low was over the central valley, Lake region and eastward. Moderate barometric depressions were reported over the south plateau and middle Canada. Light precipitation occurred over the Atlantic States, lower Lake region and Ohio valley.

Temperatures in Other Places.		
	Min.	Max.
Boise	50	74
Boston	40	48
Chicago	40	48
Cincinnati	36	64
Denver	36	65
Detroit	34	42
Duluth	32	46
Kansas City	40	62
Los Angeles	60	72
New Orleans	66	74
New York	36	54
Omaha	38	56
Pocatello	40	62
Portland, Or.	50	56
St. Louis	38	56
St. Paul	36	54
San Francisco	54	66
Washington, D. C.	38	60
Yuma	60	80

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